2017 NOAA Emerging Technologies Workshop (ETW)
Capability Gap
Request For Information (RFI)

Schedule of Key Dates:

Submitter must send questions to AGO by:	**Tues, May 23, 2017,** 5:00 PM Eastern
AGO to respond to Submitter questions by:	**Thur, June 1, 2017**
RFI closes (no submissions after):	**Tues, June 6, 2017,** 5:00 PM Eastern
Invitations to present will be sent out by:	**Tues, July 11, 2017**
Invitees must confirm acceptance by: (if accepting invitation, confirmation is mandatory)	**Tues, July 25, 2017** (acceptance is optional)
Presenters must register for the ETW by: (if presenting, registration is mandatory)	**Fri, July 28, 2017**
Presenters must submit slides by: (if presenting, slides are mandatory)	**Fri, August 4, 2017**
Invitees must submit poster by: (poster submission is optional)	**Fri, August 4, 2017**
Cancellation deadline:	**Fri, August 4, 2017**
Workshop presentation date:	**Wed, August 23, 2017**

THIS IS A REQUEST FOR INFORMATION (RFI)

This is an RFI only and is not a solicitation for a contract or grant award. It is not a request for proposals, and it does not obligate the government in any way. The Government will not reimburse the respondents for any costs associated with the information submitted in response to this request.

This is a request for information only, and does not obligate the government to reimburse any costs associated with the preparation and/or submission of this information. Nor does this RFI guarantee that the government will issue a request for proposal or award a contract for supplies or services. No specific RFP is planned to follow this RFI; however, the responses could impact the government's decision to release an RFP in the future.

The Government shall not be liable for or suffer any consequential damages for proprietary information not properly identified. Proprietary information will be safeguarded in accordance with the applicable Government regulations.

Travel and incidental expenses associated with participation in the 2017 NOAA Emerging Technologies Workshop will be borne by the submitting entity; the Government shall not reimburse any expenses.

SECTION I. INTRODUCTION

Background Information

American citizens, businesses, and communities rely on NOAA's environmental intelligence to make decisions that impact lives and livelihoods. The foundation for NOAA's work is its ability to accurately measure environmental parameters from the depths of the ocean to the surface of the sun. NOAA's observing systems portfolio is composed of these measurements, their related instruments, platforms, associated data processing, products generation, and dissemination systems. Measurements are drawn from systems operated by NOAA or other federal agencies, international partners, academia, nongovernmental organizations, private industries, and community-based entities (citizens, organizations, etc.).

Nearly one-half of NOAA's annual budget is invested in acquiring and sustaining observing systems. The processes used to manage the observing systems portfolio (and associated budgets) are complex and dynamic. Ultimately, qualified scientists define the essential parameters that establish observing system requirements. They do so through regular interaction with users and providers of collected data, and through reviews of current and expected applications that depend on these measurements. The established requirements are then matched to available technologies, leading to the selection or development of instruments designed to collect specific measurements.

The design, development, and eventual deployment of an observing system, along with the infusion of new technology to recapitalize or enhance performance, often requires complex planning, programming, and budgeting. While the overall process depends on the availability of accurate scientific measurements, it also relies on robust information technology systems that collect, process, disseminate, and display data.

As part of NOAA's observing system portfolio management, NOAA seeks to identify emerging technologies for Earth and space observation, and develop recommendations to help NOAA infuse new technology into the observing systems portfolio.

Purpose of this RFI

The purpose of this RFI is to solicit responses from federal agencies, academia, and industry to identify opportunities for enhancement to NOAA's Observing System Architecture.

The National Oceanic and Atmospheric Administration (NOAA) is conducting an Emerging Technologies Workshop in College Park, Maryland, at the NOAA Center for Weather and Climate Prediction to identify new environmental observing capabilities and applications for synthesizing environmental information which have the potential for improving NOAA services and enhancing organizational efficiencies. High priority environmental observational data characteristics included in **SECTION IV. Listing of Requirements Gaps.**

NOAA is interested in improved access to environmental data from the following sources:

- New environmental observing platform/sensor capabilities

- Innovative data processing techniques to improve data synthesis, and
- More efficient observing system/network/constellation solutions including system-of-system approaches

The goal for this workshop is to improve awareness of emerging observing technologies and to facilitate discussions on associated opportunities and challenges. The information provided to the Government for this workshop may be used to inform future Requests for Proposals (RFPs), feasibility studies, and trade studies to improve efficiencies and fill gaps in NOAA's observing system architecture.

Responses to his RFI will be considered for inclusion in the 2017 NOAA Emerging Technologies Workshop program, and may receive an invitation to present at the workshop and/or provide a (virtual or physical) poster. The government is not obligated to provide any response whatsoever to your submission; however, the workshop organizers will make their best attempt to inform all submitting entities as to their submission's dispensation in regards to the workshop program. NOAA reserves the sole right of final approval for all presentations and poster materials included in the 2017 NOAA Emerging Technologies Workshop program.

--- This is the end of this section ---

SECTION II. INFORMATION REQUESTED

The 2017 NOAA Emerging Technologies *for Observations* **Workshop**

The National Oceanic and Atmospheric Administration (NOAA) is conducting the second-annual **Emerging Technologies** *for Observations* **Workshop** to identify new environmental capabilities and applications for generating environmental information which have the potential for improving NOAA services and increasing organizational efficiencies.

The workshop will focus on technologies that could replace and/or improve current capabilities, lower costs, fill information requirement gaps, and/or could enhance the balance and cost effectiveness of NOAA's observer system portfolio. Respondents to this RFI are strongly encouraged to identify emergent capabilities have the potential to fulfill high priority environmental information needs listed in **SECTION IV.**

NOAA is interested in technology for which capabilities have been demonstrated in a relevant environment consistent with the capability's intended use. Your proposed capability must be **Technical Readiness Level 6** or higher, such that it could, with additional development, be available in an operational environment within 1-5 years.

- *See the Appendix for a complete list of Technical Readiness Levels (TRLs) and their definitions.*

Selected RFP submitting entities will be invited to provide a 10-minute in-person presentation during one of two workshop sessions (see **SECTION IV** intro: Workshop Sessions Devoted to Requirements Gaps). Submitting entities which are not selected to give an in-person

presentation may be invited to submit a technical poster instead, to be posted online in the workshop's virtual poster gallery. Being selected to present an in-person presentation will require you, or your designate, to travel to College Park, Maryland, to attend the second day of the two-day workshop on **Wednesday, August 23, 2017.** If you are only submitting a poster, you may send a digital copy. There is no need to present posters in-person.

--- This is the end of this section ---

SECTION III. INSTRUCTIONS FOR SUBMISSION

NOAA Point of Contact

Sarah Waugh, Contracting Officer, NOAA/AGO/SIAD; sarah.waugh@noaa.gov, (206) 526-6544

Respondents are hereby notified that NOAA may share RFI responses with other government agencies, especially the National Aeronautics and Space Administration (NASA), and that the government may utilize Federally Funded Research and Development Centers (FFRDCs) and support contractors to provide technical advice and evaluate responses. All personnel assigned to assist in the RFI assessment will sign both non-disclosure and conflict of interest forms and will be made aware that responses shall not be duplicated, used, or disclosed in whole or in part for any purpose other than to consider the response. If vendors decide not to respond to this call for papers, or participate in the ETW, it will not preclude them from participate in future related NOAA activities or submitting a proposal for any subsequent competitive NOAA solicitations.

Clarifying Questions: Issues and questions regarding this RFI shall be submitted to the Contracting Officer at the e-mail address provided above by **May 23, 2017** at 5:00 PM Eastern Time. Respondents should be advised that answers to submitted questions will be posted to FedBizOpps for all respondents to review, although the identity of the requesting organization will be withheld. Respondents may reply to some or all of the RFI.

Submission Deadline: RFI responses must be received by the Contracting Officer at the e-mail address provided above in soft-copy **no later than 5:00 PM Eastern Time on June 6, 2017.** The government is not obligated to review responses to this RFI received after the deadline. Respondents may be contacted with questions or clarifications during the initial review process and should be prepared to submit responses within one week.

Response length limitations: We request that answers to the **Base List of Questions (SECTION V)** be included in your submission. Answers to **Questions #10 and #11** must be limited to **two short essays to not more than 600 words each.** Your complete submission may include additional supporting figures, tables, graphics, pictures, or appendices - **but is limited to not more than 12 pages in total, including any title page.** Any supporting materials included in your submission should be relevant to the observing system capability that you propose.

A page is defined as each face of an 8 1/2 by 11 inch sheet with information contained within an image area of 7 by 9 inches. Type size shall be 12 point proportional font. Information shall be submitted in Microsoft Word or Adobe Acrobat (PDF) format. **The government is not obligated to review or consider responses which do not adhere to the stated word limits and page limits.**

For those invited to present in-person: The government is not obligated to select or respond to any submission in any way, shape, or form; however, the workshop organizers will attempt to inform the point of contact for all submissions whether they have been selected to present at the workshop, or if they will have the option of submitting a technical poster instead. If your submission is selected to present at the workshop, the workshop organizers will attempt to notify the point of contact for your submission by **July 11, 2017**.

Accepting your invitation to present: Those who are selected to present at the workshop must confirm that they are willing and able to travel to College Park, Maryland, for the purpose of giving a ten (10) minute stage presentation on their observing systems capability to the assembled audience at the 2017 NOAA Emerging Technologies Workshop on **August 23, 2017**. All presentations must be made in person. The government will not accommodate presentations made remotely. Presentations will be timed, and must be suitable for a general audience of federal employees, non-federal and contractor attendees.

In order to accept this invitation, the invited party must do all of the following: **(a)** accept their invitation to present by **July 25, 2017** by confirming their willingness and availability to attend the workshop in person to give a live ten-minute presentation about their proposed capability, **(b)** register for the 2017 NOAA Emerging Technologies Workshop by **July 28, 2017**, and **(c)** submit their presentation slides to the workshop coordinators for review by **August 4, 2017**.

Workshop Registration: Registration is free to all participants; however, seating is limited. If you are selected to present, the workshop coordinators will reserve two seats for you and one colleague, or up to two designates. Additional seats are subject to availability. The government will provide **no travel funding of any kind** for the purposes of attending the workshop. No other payments, honorariums, or compensation of any kind, will be given in exchange for attending the workshop, presenting at the workshop, or submitting a technical poster for the workshop. The cancellation deadline for those who have registered to attend the workshop is **August 4, 2017.**

Optional poster submission: In the event that the submitting entity is invited to submit a technical poster in lieu of giving an in-person presentation, you must submit the final soft-copy of your poster no later than **August 4, 2017**. Technical posters submitted after this deadline may not be accepted. By submitting a poster, you are giving the government permission to display or post your poster online, making it available on the workshop's website for public access. The government is not obligated to provide any funding for the production or shipping of a hard-copy of your poster submission.

NOAA thanks all respondents in advance for expending the time and resources in support of this critical activity.

--- This is the end of the Instructions for Submission ---

SECTION IV. LISTING OF REQUIREMENTS GAPS

Workshop Sessions Devoted to Requirements Gaps

Abstracts will be grouped into the following two workshop sessions, according to the abstract topic's Earth phenomena characterization:

- **Workshop Session 1: Ocean Information Gaps Session.** In situ or remotely sensed characterization of environmental phenomena and geo-physical properties environment from the ocean surface to the ocean floor; bounded from the land by the mean low water level of the coasts.
- **Workshop Session 2: Land & Atmosphere Information Gaps Session.** In situ or remotely sensed characterization of environmental phenomena and geo-physical properties environment:
    - **Atmosphere:** From 10 meters to about 100 kilometers above sea level.
    - **Terrestrial:** From 2 meters below the soil to 10 meters above the ground level; bounded from the ocean by the mean low water level of the coasts.

Desired environmental observations and analyzes for which include the data characteristics. The key environmental attribute gap is highlighted in yellow.

Session 1. Ocean Environmental Information Gaps

The Ocean Information Gaps Session will focus on identifying promising capabilities which have the potential to fulfill core ocean geo-physical parameter gaps, several of which are cited in the World Meteorological Organization (WMO) Statement of Guidance (SoG) for Ocean Applications, April 2016.

There are **FOUR** possible Ocean Environmental Information Gaps from which to choose. If you are proposing a capability for the **The Ocean Information Gaps Session,** your proposed capability must address at least one of them (but may address more than one). They are:

Gap 1.a Global Ocean Temperature Profiles

Narrative: NOAA has developed mobile "float" systems that measure the ocean depths to 6,000 meters (ARGO), and deployed moored tropical buoy arrays which address climate and seasonal weather missions. The relatively rapid changes that occur in the ocean's mixed layer remains substantially unresolved.

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Vertical Domain	Update Interval
Global Ocean	25 km	2 m	0.1 K	Surface to 250 m	10 days

Gap 1.b Global Salinity Profiles

Narrative: Seawater salinity has become an important variable to measure in order to address the needs of operational application such as operational ocean forecasting, seasonal to inter-annual forecasting, climate monitoring and services, as well as those of physical oceanography research. Indeed, together with water temperature, ocean salinity drives water density, and as such is important for ocean circulation. Ocean surface salinity is also useful for monitoring and understanding the water cycle, which is linked for example to evaporation and precipitation over the oceans, river runoff, and the melting and freezing of sea ice. (JCOMM)

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy (Absolute Salinity (S_A))	Vertical Domain	Update Interval
Global Ocean	25 km	2 m	0.05 g/kg	Surface to 250 m	10 days

Gap 1.c Ocean Current Profiles (Circulation/Velocity)

Narrative: Surface currents measured by drifting buoys are acceptable in terms of accuracy and temporal resolution but marginal in spatial coverage. Moored buoy observation has good in accuracy and frequency but poor-to-marginal in spatial coverage. Satellite altimetry is also being used to infer the distribution of near-surface ocean currents. (WMO Sub-Seasonal to Long Time Scale Predictions SoG,Sec. 2.1.7, Ocean Current Data, April 2016)

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Vertical Domain	Update Interval
Global Ocean	100 km	10 m	0.005 m/s	Surface to 250 m	5 days

Gap 1.d Coastal Sea State (Significant Wave Height)

Narrative: Marine forecasters use sea state information to issue forecasts and warnings of important wave variables (such as, significant wave height and dominant wave period) for their area of responsibility and interest, in support of several marine operations. Sea state observations are also required for nowcasting (0 to 2 hours) and issuing / cancelling warnings, very-short range forecasting (up to 12 hours). (WMO SoG Ocean Applications) Coincident wind reports are highly desired.

Attribute Desired Analysis:

Geo Coverage	Parameter	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Update Interval
Coastal US	Dominant Wave Period	20 km	NA	1.0 sec	15 mins
Coastal US	Significant Wave Height	20 km	NA	0.3 m	15 mins

--- This is the end of the List of Ocean Environmental Information Gaps ---

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Session 2. Land & Atmosphere Environmental Information Gaps

The Land & Atmosphere Information Gaps Session will focus on identifying promising capabilities which have the potential to fulfill core land, coastal and atmospheric geo-physical parameter gaps, several of which are cited in the World Meteorological Organization (WMO) Statement of Guidance (SoG) for Global Numerical Weather Prediction (GNWP)).

There are **SIX** possible Land & Atmosphere Environmental Information Gaps from which to choose. If you are proposing a capability for the **The Land & Atmosphere Information Gaps Session,** your proposed capability must address at least one of them (but may address more than one). They are:

Gap 2.a Bathymetry/Hydrography

Narrative: Observations of bathymetry, coastal topography and shorelines are required for ocean and coastal modelling. Very high resolution data are required due to the gradual changes of the coastline through erosion and accretion processes relating to coastal meteorological and oceanographic phenomena (e.g. waves, storm surges and sea ice). (WMO SoG, Ocean Applications, Sec. 2.10, April 2016)

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Horizontal Measurement Accuracy	Vertical Measurement Accuracy	Update Interval
Coastal US	2 m	0.1 m	1 m	0.05 m	2 years

Gap 2.b Coastal US Wetland/Land Cover

Narrative: Wetland and land cover information is used improve the understanding of coastal uplands and wetlands, and their linkages with the distribution, abundance, and health of living marine resources. Land cover is also useful in inundation mapping.

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	# Wetland Classifications	Horizontal Measurement Accuracy	Classification Accuracy	Update Interval
Coastal US	30 m	NA	50	1 m	>70%	1 year

Gap 2c. Coastal US Topography/Elevation

Narrative: Observations of bathymetry, coastal topography and shorelines are required for ocean and coastal modelling. Very high resolution data are required due to the gradual changes of the coastline through erosion and accretion processes relating to coastal meteorological and oceanographic phenomena (e.g. waves, storm surges and sea ice). (WMO SoG, Ocean Applications, Sec. 2.10, April 2016)

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Horizontal Measurement Accuracy	Vertical Measurement Accuracy	Update Interval
Coastal US	2 m	0.1 m	0.1 m	0.05 m	5 years

Gap 2d. Global Wind Profiles, Direction and Speed

Narrative: 3D field of the vertical component of the 3D wind vector over the global above the surface (10 meters AGL). Horizontal and temporal resolution is acceptable or good, but vertical coverage is marginal. There are very few in situ wind observations from the Polar Regions. In the lower stratosphere, only radiosondes provide wind information. Accuracy is good/acceptable for in situ systems and acceptable/marginal for satellite winds. (WMO SoG for Global Numerical Weather Prediction (GNWP)).

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Vertical Domain	Update Interval
Global	200 km	2.0 km	1.5 m/s	10 m to 16 km	6 hours

Gap 2e. Surface Winds - US Marine Zones

Narrative: Improved wind measurements at the surface of the ocean to 10 meters above the ocean,from the US shoreline to 25 miles offshore are needed. High-resolution surface wind vectors over the ocean

and coastal areas are required as an input field to ocean models (including wave models) for marine services, marine modelling and atmospheric modelling. The surface wind-field is a key variable for driving ocean models and to nowcast and forecast marine meteorological and oceanographic conditions. It is strongly influenced by the coastal topography and land-sea surface conditions. (WMO SoG, Ocean Applications, Sec. 2.11, April 2016).

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Update Interval
US Marine Zones	**10 km**	**NA**	**1.5 m/s**	**1 hour**

Gap 2f. Surface Winds - US States and Territories

Narrative: Winds at the surface of the earth (10 meters AGL) over US states and territories are essential for nowcasting weather, issuing and verifying weather warnings, supporting surface transportation, especially terminal aviation operations, and as input for high resolution numerical weather predictions. High quality metadata describing instrument siting and maintenance is essential to determine appropriate use of the data. Coincident sea level pressure measurements are highly desired.

Attribute Desired Analysis:

Geo Coverage	Horizontal Resolution	Vertical Resolution	Parameter Accuracy	Update Interval
CONUS+AK+HI+US Territories	**10 km**	**NA**	**1.5 m/s**	**15 minutes**

--- This is the end of the List of Land & Atmosphere Environmental Information Gaps ---

--- This is the end of Section IV: Listing of Requirements Gaps ---

SECTION V. BASE LIST OF QUESTIONS

You are requested to provide the following information for the observing system capability that you wish to propose for consideration. *Indicates a word that is further defined in the Appendix.

1. What is the name and contact information of the person submitting this response to the RFI, and the name and contact information of the submitter's organization? Please provide the following:
    - *First & Last name (Who is the primary point of contact for this RFI submission?)*
    - *Submitter's Agency, Company, Institution, or Organization*
    - *Unit, Division, or Office (of the above-listed entity)*
    - *Submitter's Email Address*
    - *Submitter's Preferred phone #*

2. What organization is providing primary funding for the development of the capability to be

discussed at the workshop? (select the most appropriate answer)

- Your company
- NOAA
- A federal agency other than NOAA. If so, which agency?
- Other

3. Are you or your organization currently performing related work for NOAA or another federal government entity? If yes, which government entity?

4. Does the funding organization own, build, or control the observing system capability that you wish to propose? (Yes/No or explain)

5. What is the **complete name** of your proposed observing systems capability?

6. Of the following two workshop sessions, to which one does your proposed capability apply? (Choose only one)
   - **Workshop Session 1:** Ocean Environmental Information Gap
   - **Workshop Session 2:** Land and/or Atmosphere Environmental Information Gaps

7. If your proposed capability applies to Session 1 only**,** which of the following Requirements Gap(s) do you believe that your proposed capability would fill the best? (Choose all that apply. If you chose Session 2 for Question 5, skip this question.)
   - **Gap 1a:** Ocean Temperature Profiles
   - **Gap 1b:** Ocean Current Profile
   - **Gap 1c:** Ocean Salinity Profile
   - **Gap 1d:** Ocean Surface Waves

8. If your proposed capability applies to Session 2, which of the following Requirements Gap(s) do you believe that your proposed capability would fill the best? (Choose at least one, but no more than four. If you chose Session 1 for Question 5, skip this question.)
   - **Gap 2a:** Bathymetry/Hydrography
   - **Gap 2b:** Coastal US Wetland Cover
   - **Gap 2c:** Coastal US Topography/Elevation
   - **Gap 2d:** Wind Profiles, Direction and Speed
   - **Gap 2e:** Surface Winds - US Marine Zones
   - **Gap 2f:** Surface Winds - US States and Territories

9. What is the current Technical Readiness Level* for the capability?
   - *Note: Your proposed capability must be at **TRL 6 or higher.** For a listing of the TRL scale with definitions, please see the Appendix.*

10. Please include here (or attach to your RFI response), an abstract for the proposed observing system capability (600 word limit). Ideally, your abstract should accomplish three objectives:

- *Provide a description of your proposed capability as though you were explaining it to a NOAA audience.*
- *Describe the system performance specification* for the capability, including nominal sensor and platform performance.*
- *Briefly describe at least one example of an early success which has already been demonstrated by your proposed capability.*

11. What do you believe would be the benefits to NOAA if the capability that you've proposed were introduced? In other words, in what way, or by what means, would your proposed capability fill, satisfy, or otherwise support the information requirements gap(s) which you indicated in Question 7 or 8? For example, will your capability complement existing capabilities or replace "legacy" capabilities? Does your capability realize new cost efficiencies? Does your capability improve data synthesis? etc. (600 word limit)

12. If the observing system capability has a publicly-accessible informational website or webpage (a webpage for the technology itself, not your organization's general website), please provide the URL here.

13. Within the 12-page limit, you may attach supporting figures, tables, graphics, pictures, or appendices that are directly relevant to the capability that you have proposed.

--- This is the end of the Base List of Questions ---

SECTION VI. APPENDIX

Definition of selected terms used in the base list of questions

Technical Readiness Level (TRL):

TRL 1: Basic principles observed and reported: Transition from scientific research to applied research. Essential characteristics and behaviors of systems and architectures. Descriptive tools are mathematical formulations or algorithms.

TRL 2: Technology concept and/or application formulated: Applied research. Theory and scientific principles are focused on specific application area to define the concept. Characteristics of the application are described. Analytical tools are developed for simulation or analysis of the application.

TRL 3: Analytical and experimental critical function and/or characteristic proof-of-concept: Proof of concept validation. Active Research and Development (R&D) is initiated with analytical and laboratory studies. Demonstration of technical feasibility using breadboard or brassboard implementations that are exercised with representative data.

TRL 4: Component/subsystem validation in laboratory environment: Standalone prototyping implementation and test. Integration of technology elements. Experiments with full-scale problems or data sets.

TRL 5: System/subsystem/component validation in relevant environment: Thorough testing of prototyping in representative environment. Basic technology elements integrated with reasonably realistic supporting elements. Prototyping implementations conform to target environment and interfaces.

TRL 6: System/subsystem model or prototyping demonstration in a relevant end-to-end environment (ground or space): Prototyping implementations on full-scale realistic problems. Partially integrated with existing systems. Limited documentation available. Engineering feasibility fully demonstrated in actual system application.

TRL 7: System prototyping demonstration in an operational environment (ground or space): System prototyping demonstration in operational environment. System is at or near scale of the operational system, with most functions available for demonstration and test. Well integrated with collateral and ancillary systems. Limited documentation available.

TRL 8: Actual system completed and "mission qualified" through test and demonstration in an operational environment (ground or space): End of system development. Fully integrated with operational hardware and software systems. Most user documentation, training documentation, and maintenance documentation completed. All functionality tested in simulated and operational scenarios. Verification and Validation (V&V) completed.

TRL 9: Actual system "mission proven" through successful mission operations (ground or space): Fully integrated with operational hardware/software systems. Actual system has been thoroughly demonstrated and tested in its operational environment. All documentation completed. Successful operational experience. Sustaining engineering support in place.

System Performance Specification:

- Provide system performance information for your capability relative to the requirements gap from **SECTION IV** that you are responding to in terms of sensors deployed, number of platforms, platform disposition (fixed or mobile), data processing methodologies, functional output of sensor data records and environmental data records, and accuracy.

Concept of Operations (CONOPS):

- General definition: A Concept of Operations, or a CONOPS statement, is a statement or document describing the characteristics of a proposed system, scalability, from the viewpoint of an individual who will use that system. It is used to communicate the quantitative and qualitative system characteristics to all stakeholders.

--- This is the end of the Appendix ---